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Part V

Environmental Protection Agency

Standards Applicable to Owners and Operators of Hazardous Waste Treatment; Storage and Disposal Facilities

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 264

[SWH-FRL-1825-2]

Standards Applicable to Owners and Operators of Hazardous Waste Treatment; Storage and Disposal Facilities

AGENCY: Environmental Protection Agency.

ACTION: Supplemental notice of reproposed rulemaking.

SUMMARY: On February 5, 1981, EPA reproposed standards for permitting hazardous waste land disposal facilities. This notice supplements the reproposal by setting forth more fully the various issues which EPA has considered in developing the standards. The purpose of this notice is to enable the public to better comment on the February 5 proposal as well as other regulatory options.

DATE: The comment period for this notice will run concurrently with that set for the February 5, 1981 reproposal. Comments must be received on or before August 4, 1981.

ADDRESS: Comments should be addressed to Deborah Villari, Docket Clerk, Office of Solid Waste (WH-562), U.S. Environmental Protection Agency, 401 M Street SW., Washington, D.C. 20460, (202) 755-9173.

Comments on the reproposed rule or today's supplemental notice should identify the regulatory docket as follows: "Section 3004: Permitting Standards for Land Disposal Facilities."

The public docket for this rulemaking is available at Room 2711B, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460 and is available for reviewing from 9:00 a.m. to 4:00 p.m., Monday through Friday, excluding hoildays.

FOR FURTHER INFORMATION CONTACT: For information on today's supplemental notice of reproposed rulemaking, contact Barry Stoll, Acting Chief, Land Disposal Branch, Office of Solid Waste (WH-564), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460, (202) 755-9116. For information on the reproposed rule, contact Robert B. Taylor, Land Disposal Branch, Office of Solid Waste (WH-564), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460, (202) 755-9120.

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I. Background

Under Section 3004 of the Resource Conservation and Recovery Act of 1976, as amended (RCRA), EPA is required to establish such performance standards, applicable to owners and operators of hazardous waste treatment, storage and disposal facilities (TSDF's), as may be necessary to protect human health and the environment. Some of these standards provide the basis for issuing permits to such facilities under Section 3005. Other standards establish the duties of owners and operators of existing treatment, storage and disposal facilities who qualify for "interim status", a period, established under section 3005(e) of RCRA, during which the facility is treated as if it has a permit. (See 45 FR 33158, May 19, 1980, for a description of "interim status".)

A. Past Rulemaking

In developing regulations under Section 3004, EPA has placed its standards for interim status facilities in 40 CFR Part 265 and those for issuing permits in 40 CFR Part 264. On May 19, 1980 (45 FR 33154) and January 12, 1981 (46 FR 2802), EPA issued a full set of regulations under Part 265 for interim status facilities. Also on May 19, 1980, EPA issued regulations under Part 264 that established certain administrative requirements for permitted facilities. The remainder of the Part 264 standards are being issued in stages. On January 12, 1981, EPA Issued permitting standards governing location of TSDF's, closure and post-closure care and requirements for TSDF's as well as specific technical standards for storage facilities. On January 23, 1981 (46 FR 7666), EPA issued technical standards for hazardous waste incinerators. With these actions, EPA has promulgated the principal elements of the Part 264 standards except for the technical standards applicable to land disposal facilities.

Technical standards for permitting land disposal facilities were originally proposed on December 18, 1978 (43 FR 58982). The basic approach taken in the December 18, 1978 proposal was to set uniform design requirements for landfills and surface impoundments, subject to opportunities for variances when alternative designs could achieve equivalent environmental protection. Many commenters criticized the proposal as being too inflexible and not adequately oriented towards a particular regulatory goal. In response, EPA reconsidered its approach and decided tentatively to move towards a site-specific risk assessment approach. On October 8, 1980, EPA published a supplemental notice of proposed rulemaking, briefly outlining the options which EPA has considered and announcing EPA's tentative selection of the risk assessment approach. A 30-day comment period was provided.

On February 5, 1981, EPA reproposed technical standards for permitting land disposal facilities. The reproposal adopted the site-specific risk assessment approach. A 180-day comment period was provided to promote full discussion of the complex

technical and policy issues concerning the various types of land disposal practices. EPA expects to promulgate final land disposal regulations in 1982.

EPA was concerned that the delay in promulgating final Part 264 standards for land disposal facilities would present problems for owners and operators of new disposal facilities, who may not begin to construct or operate these facilities without permits.[1] (Owners and operators of existing facilities who have qualified for interim status may continue to operate.) New land disposal facilities cannot receive permits until EPA has issued standards for such facilities. EPA was concerned that the delay in issuance of land disposal standards operated effectively as a moratorium on new land disposal facilities, a situation which could undermine the nation's need for environmentally-acceptable disposal capacity and could cause unnecessary economic hardship. Therefore, on February 13, 1981, EPA issued a temporary, interim standard for new land disposal facilities (40 CFR Part 267, 46 FR 12414) to provide a basis for issuing permits. This standard becomes effective on August 13, 1981.

B. Purpose of Notice

In developing the February 5 proposed regulations, EPA has had to consider a variety of broad and complex technical and policy issues and to choose from a large menu of regulatory options. The October 8, 1980 supplemental notice of proposed rulemaking briefly outlined some regulatory options that the Agency had considered.

Following the October 8, 1980 notice, EPA proposed the risk assessment approach in the February 5, 1981, standards. EPA provided a 180-day comment period on this proposal. EPA recognizes that providing the public a continued opportunity during the comment period to comment on all issues, relating to all potential regulatory approaches, would be beneficial. The purpose of this notice is to assist the public in considering these issues.

In this notice, EPA has tried to explain not only the available regulatory options but also the fundamental policy and technical issues underlying the selection of any approach. We hope that the notice will assist the public to evaluate and comment upon the various regulatory options.

Public comment on all issues relating to the land disposal of hazardous wastes will also assist EPA in complying with Executive Order 12291, signed by the President on February 17, 1981. The Executive Order requires all federal agencies, in promulgating major new rules, to prepare regulatory impact anslyses. For each such rule, the analysis must describe potential benefits and costs (including non-quantifiable benefits and costs) of the rule, determine the potential net benefits of the rule, and describe alternative approaches that could substantially achieve the same regulatory goal at lower cost. In addition, the anslysis will include an analysis of effects on small businesses as required by the Regulatory Flexibility Act.

Although EPA believes that in some cases, it may be appropriate to prohibit the land disposal of certain hazardous wastes, in other caes land disposal may be the most acceptable management option. It is our intent in developing final land disposal standards to consider intermedia trade-offs and to evaluate land disposal on the same basis as any other hazardous waste management option, allowing it to continue where there is adequate assurance that human health and the environment can be protected.

C. Format of Notice

This notice is divided into several sections. Sections II and III discuss the broad land disposal policy issues which EPA believes must be addressed in any regulatory approach. The remaining sections examine in some detail what we believe are the principal options available to regulate land disposal facilities and raise specific questions relating to these options.

The discussion reflects the present technical sophistication in designing land disposal facilities and estimating their environmental impacts. All experts agree that particular types of factors and mechanisms are relevant in designing and evaluating these facilities. The debate now focuses on detail: How critical is factor X in predicting the migration of contaminant Y? What is the degree of confidence with which one may predict that a particular design will now fail due to the occurrence of a particular type of unfavorable circumstance? EPA requests that commenters addressing the technical issues raised in this notice focus on these difficult issues rather than on generalities which are already well known and not subject to dispute (e.g., that bio-degradation and sorption are relevant to land disposal issues).

Further, the discussion concerning land disposal reflects the general technical consensus that complete containment of disposed wastes can be achieved only for a limited period; that any facility thus presents some risk; and that in designing and regulating land disposal facilities, one must focus upon limiting risk to acceptable levels. These questions broadly address the options for limiting risk in light of the uncertainty in the present scientific state of the art and the resources available to implement any selected policy option.

II. Preliminary Issues Concerning Risk

Hazardous wastes contain constituents which may present health and environmental risks for long periods of time. Many organic constituents are stable (degrade very slowly); other hazardous constituents (e.g., toxic metals) never degrade. Yet the existing technology for disposing of hazardous wastes on or in the land cannot confidently isolate these wastes from the environment forever.

Since disposing hazardous wastes in or on the land inevitable results in the release of hazardous constituents to the environment at some time, any land disposal facility creates some risk. RCRA requires EPA to establish such standards "as may be necessary to protect human health and the environment." Thus, EPA's task is to assure that risks from land disposal facilities do not exceed a level which is determined by some means to be acceptable.

The means of assuring acceptable risk include direct risk assessment, indirect methods such as design requirements or performance goals, or prohibitions that require that wastes be treated or disposed of by means other than land disposal. These approaches are discussed in detail in subsequent sections of this notice.

Before discussing and selecting appropriate means for reducing risk to acceptable levels, however, one must define the types and degrees of risks which can and should be considered. Furthermore, one must decide who is the appropriate party to determine acceptable risk. These broad but essential preliminary issues are discussed immediately below. Commenters are invited to address these broad issues either directly or in the context of discussing the more specific questions raised in subsequent sections of this notice.

A. To What Extent Can and Should Risks to Future Generations Be Considered?

In disposing of hazardous wastes that will remain potentially dangerous for many thousands of years, society has some responsibility to protect future

[1] A detailed discussion of these problems is set forth at 46 FR 12414–12417, February 13, 1981.

generations. But, while some duty to protect future generations is implied in all environmental regulations, to what relative degrees should protection be provided to today's and tomorrow's populations; that is, how can today's society equitably allocate risk over time?

This issue requires recognition of an essential distinction between present and future generations. Present-day society produces a variety of economic goods (e.g., cars, electrical appliances and plastic goods), resulting in generating and disposing of hazardous wastes. Thus, society accepts some degree of risk in return for the economic benefits of production. However, the risks imposed by today's land disposal upon society in the year 2080, for example, will be accompained by fewer corresponding economic benefits, since many of the goods produced today (or the infrastructure for producing those goods) will no longer be in use (or existence) in 2080. Thus, one may argue that the imposition of risk on future generations by today's land disposal activities for present economic gains may be unfair even in some situations where the same risk would be acceptable to present-day society.

A resolution of this issue requires a consideration of several subordinate issues. First, what assumptions may be made concerning future exposure to hazardous waste? For example, if the quantity of water consumption increases in the future or if available water sources are depleted (e.g., mining of ground-water resources which are not replenished naturally or artificially), then water which presently is unused may need to be used in the future for drinking or other purposes. Current trends in water usage in the United States do indicate an increasing need to tax previously unused ground-water resources. These trends include depletion or pollution of existing ground-water resources, and changing land use patterns which result in the development of formerly pristine areas and the increased use of ground water in these areas. If such trends continue, future generations may be forced to either allocate scarce water (by increasing the cost of consumption or by other means), treat the contaminated water, or increase risk by using the contaminated water. However, if such trends do not continue, then the contamination of ground water near selected and identifiable land disposal sites presents less of a danger to future populations, provided that contaminated ground water can be identified and its use limited accordingly. (Similarly, land use changes caused by population growth and other factors may or may not result in other types of exposures to wastes disposed in areas previously considered remote.)

Second, how likely is it that future societies will have developed the techological and economic capability to recover and treat wastes and to restore contaminated soil, ground water or surface water to their noncontaminated states, thereby reducing exposure to wastes? Can any sensible assumptions concerning future technological capability be made at this time?

Third, what assumptions can be made concerning the institutions available to provide long-term protection from hazardous wastes? Some institutional mechanisms are already being put into place under RCRA. See 40 CFR Parts 264 and 265, Subparts G and H. For example, most regulatory options discussed later in this notice would require some degree of post-closure care. This care may include long-term maintenance and ground-water monitoring together with a pre-financed fund to ensure that these activities can be carried out. In addition, EPA must make some assumptions about other institutional mechanisms (e.g., local land use controls, state or Federal clean-up efforts, common-law tort remedies and disclosure in private property transactions) that could achieve protection of future generations but that are not under EPA control. This issue suggests at least the following subsidiary questions:

i. Can and should owners or operators of land disposal facilities be relied upon to implement perpetual care (or long-term care, depending on whether and how rapidly the wastes decompose over time), if such care is required to successfully implement the selected regulatory option? Can and should they be required to set up financial mechanisms in advance which will assure long-term availability of adequate funds?

ii. Can and should a Federal, state or local agency be charged with the responsibility for long-term monitoring and maintenance of closed land disposal facilities? What special arrangements could be established to finance these activities? Can a governmental agency be relied upon to provide care for centuries if such care is or becomes necessary?

iii. Apart from owners or operators and governmental agencies, what other institutional arrangements may be used to assure long-term care and the existence of funds to pay for such care? Would a national fund analagous to but broader than that contained in section 107(k)(3) in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (the post-closure liability fund) be appropriate? How should such a fund be financed: through general revenue, or through a tax on hazardous waste generators or land disposal facilities? As an alternative, could private funds (such as annuity funds or trust funds) be used?

EPA recognizes that predicting the future is conjectural at best. However, a decision on the degree of protection provided to future generations will be implicit in any regulatory approach. Thus, this issue must be faced squarely, based upon an analysis of past and present trends and a reasonably projection of future trends.

B. What Types of Risks (Effects Upon Human Health and the Environment) Are of Concern?

An evaluation of the total adverse effects caused by a land disposal facility requires consideration of the constituents of the wastes, the fate and transport of those constituents in the facility and into and through the environment, the extent of human and environmental exposures to the constituents, and the vast array of potential effects which the constituents may have upon people and the environment. The ability to consider all of these factors is constrained both by the limits of technical knowledge (e.g., the effects of many constituents are not well known at this time) as well as by the limits of available time and resources to perform the required analyses.

Therefore, it is appropriate to ask which of the many possible effects to people (e.g., cancer, liver damage, mild nausea), animals and plants and other parts of the environment (e.g., ground-water which may be used as a water source for irrigation or industrial cooling water) should be considered and the weight which should be assigned to these various effects. Should a regulatory approach consider all types of effects? What effects, if any, are so minor as to be not worth considering?

C. How Should the Degree of Risk be Calculated?

To assess the numerical risk presented by a particular facility in a particular location, one must attempt to calculate the risk and then decide whether that risk is acceptable. The extent to which this numerical calculation and risk assessment is performed depends on the regulatory approach. Conversely, the selection of a regulatory approach depends in part on

the extent to which actual calculation of risk is considered desirable or feasible.

First, the regulations could pursue some type of "zero" risk approach. As indicated earlier, it is probably impossible to avoid all releases of hazardous waste constituents forever. Yet it is possible to design facilities to contain wastes for some period of time and thereby achieve a zero or near-zero risk level during that period. Likewise, it is possible to prohibit the siting of disposal facilities in certain locations and thereby achieve zero risk from hazardous waste in those locations. Under this approach, calculating risk is not necessary. Examples of a hazardous waste regulation requiring the containment of hazardous wastes are the regulations for hazardous waste storage regulations in 40 CFR Part 264, Subparts I–L (46 FR 2802, January 12, 1981).

Second, the regulations may require facilities to be designed and managed in ways that limit risk, as defined by technical criteria. This approach, like containment, does not involve the calculation of risk and determination of acceptability of risk at particular facilities. Rather, it attempts to limit the total risks to society produced by all such facilities by setting stringent requirements. An example of this approach is contained in the standards for incinerators (40 CFR Part 264 Subpart O, 46 FR 7666, January 23, 1981). Those standards require, among other things, 99.99% destruction and removal of the principal organic hazardous constituents in the waste and a limitation of particulate emissions to 180 milligrams per day per standard cubic meter. Of course, reliance on uniform design and operating standards creates the possibility that the risks created under the standards are more or less than society would accept if it could and did conduct detailed numerical risk assessments for each facility. (Readers should note that, partly due to this last consideration, on January 23, 1981, EPA proposed amendments to its incinerator requirements to allow case-by-case risk assessment to be used as a variance from the 99.99% destruction and removal requirements.)

Third, the regulations could explicitly address the risk issue. The risks posed by a particular facility could be calculated, subject to uncertainties inherent in such calculations. The calculated risks (including the range of uncertainty) would then be judged for acceptability. The judgment could be based upon a uniform acceptable level determined in Federal or state regulations or upon an individual determination made by a permit writer. (See subsection D below, which discusses who should determine acceptability of risk.) An explicit risk assessment approach is contained in EPA's proposed land disposal regulations of February 5, 1981.

D. Who Should Determine Acceptable Levels of Risk?

Generally, when EPA sets standards for classes of facilities under any of the environmental laws which it implements, it sets uniform national standards. Uniform standards assure fairness by imposing similar costs upon similar facilities. They also lessen competition among states for new industry by setting uniform minimum environmental protection requirements. However, they also limit local determination of the desirable degree of environmental protection. Under section 3009 of RCRA, states may not have less stringent requirements than required by the national standards. (However, section 3009 does permit more stringent requirements.)

Section 3004 of RCRA expresses Congress' intent that EPA write nationally applicable standards. However, even national standards can be written to allow certain local determinations based upon local factors such as local hydrogeological conditions, the types of wastes being disposed at particular facilities, and local water usage and land use patterns. Going one step further towards local determination, a regulatory approach could allow even goals as well as the means to achieve those goals to be determined locally. For example, the reproposed land disposal regulations require the permit issuing authority to assess the risks posed by the facility and to determine whether they are acceptable. The regulations contain some numerical standards, but, for many constituents, acceptability is to be determined by the permit writer/

Allowing risk accepability to be judged at the state regulatory level could result in a facility in one state being judged as acceptable at the same time that a facility with similar site-specific conditions in another state is judged as unacceptable. Similar discrepancies could occur even within a state if the judgments are made by permit writers on a case-by-case basis.

How should decisions on the various elements of risk be allocated between national and state decisionmakers? If states make the decisions, to what extent will interstate competition for industry lower standards below that which is desired by the states and their citizens? In addition, if states make the decisions, should decisions be made uniformly through state regulation or on a case-by-case basis by permit writers?

III. Regulatory Perspectives

Once the broad policy issues discussed above are decided and regulatory goals are established, a means to implement the goals by issuing and denying permits must be developed. In setting standards under section 3004, EPA is mindful that the regulatory program must be capable of operating efficiently and of assuring the public that human health and the environment will be protected.

A. Assurances to the Public

The public has become justifiably concerned about the dangers presented by hazardous waste, and EPA strongly believes that the standards it sets under Section 3004 must provide reasonable assurances that the public's legitimate concerns about hazardous waste will be addressed. The RCRA permit must be formulated not only to require a certain level of protection but also to provide reasonable assurances that the level will in fact be achieved.

Some uncertainty is inherent in land disposal of hazardous waste. Many hazardous wastes are complex mixtures of chemical substances, each of which has unique properties. In addition, complicated waste interactions and hydrogeological and other environmental factors make it difficult to confidently predict the degree of containment, attenuation, or migration of waste constituents with precision. Finally, the health and environmental effects of most hazardous waste constituents are not always well understood, and synergistic and antagonistic effects of combinations of these constituents are even less well understood. Thus, uncertainty is a key problem that EPA must cope with in developing its land disposal regulations.

This uncertainty takes two principal forms. First, there is uncertainty in predicting potential effects of a given hazardous waste management scenario. Some possibility of error is always present. The questions to be considered are: (1) What degree of error can we tolerate in predicting a facility's performance or the potential adverse effects of wastes in the environment and still be able to say with some confidence that certain minimum levels of protection will be achieved? (2) What approach is appropriate when lack of knowledge results in an acceptable range of error? Can supplementary requirements compensate for error in making predictions?

Second, there is uncertainty concerning the way that the individuals and institutions that manage hazardous waste will behave. Any regulations controlling hazardous waste management must assume and compensate for human error. To provide a reasonable assurance of safety to the public, EPA must determine what margin of safety it should provide against the uncertainties of human behavior.

B. Need to Have Implementable Program

No regulatory program is acceptable if it cannot be operated efficiently by EPA and the approved states. Permitting agencies must be able to issue permits to environmentally-acceptable facilities. The chosen goal must be accompanied by a regulatory scheme which makes maximum and efficient use of available resources in an effort to collect sufficient amounts of data to develop permit requirements for the particular conditions at each individual site, but at the same time does not become a roadblock to issuing all necessary permits. Similarly, the approach cannot involve too much uncertainty, thereby inviting public opposition in hearings and litigation, which would also result in too few permits. Since there are a large number of existing land disposal facilities, an inefficient regulatory approach could jeopardize EPA's general effort to provide environmentally-acceptable disposal capacity nationwide and to phase out those facilities which are unacceptable.

EPA is concerned about the amount of time which permitting authorities' staffs would be required to spend in attempting to implement any particular regulatory approach. Unless the approach is carefully crafted, some permit applications could not be reviewed due to insufficient manpower. Another constraint is the degree of expertise needed to evaluate permit applications under a given regulatory approach. For example, the existing national pool of experts on the fate and transport of waste constituents in the environment is extremely limited.

EPA is also concerned about the burden which various regulatory approaches place on the regulated community. In addition to the costs of capital equipment and operating expenses, EPA is interested in the costs involved in preparing, analyzing and justifying a particular facility design and operating plan. EPA recognizes that there is a limited amount of resources available to provide environmental protection. EPA is, therefore, concerned about how various regulatory approaches affect the relative allocation of resources between environmental control equipment (including operating costs) and the data collection or analyses needed to prepare a complete permit application.

EPA urges commenters to address the issue of resource demands when they comment upon the options described later in this notice or other options which they may propose.

C. Regulatory Approaches

The following are the principal conceptual approaches available for regulating hazardous waste land disposal:

1. *Design and Operating Standards.* These are standards which specifically require permittees, to install particular pieces of equipment or use particular practices. This approach may include prohibitions against certain activities. Typical examples include liner specification (e.g., 5 feet of clay with a permeability of 10^{-7} cm/sec.) or a prohibition against disposing certain types of wastes in landfills.

2. *Technical Performance Standards Based on Best Available Technology.* Performance standards specify particular goals that permittees must achieve, allowing each permittee to choose any management method of his that satisfies the goal. A technical performance standard is one that is linked to the performance of a particular design or operating element of the facility.

The selection of the performance goal may be based on a decision about what the "best available technology" (BAT) performing a particular function can achieve. An example of a BAT technical performance standard is a requirement that a facility be designed to allow no more than a certain percentage of the disposed waste to enter the environment annually. The choice of "best" generally includes some consideration of cost, since almost any facility's performance may be improved by spending additional money for additional or better control.

3. *Technical Performance Standards Based on Acceptable Risk.* A technical performance standard could also be based on a decision that a particular level of performance achieved by a technology is adequate to protect against unacceptable environmental risk. An example might be a standard requiring containment of wastes for a certain number of years, based upon a judgment that the requirement provides an appropriate allocation of present and future risk.

4. *Environmental Performance Standards.* Such standards seek to set limits on what may be tolerated in the environment. This may take the form of risk specifications (e.g., 10^{-6} probability that an individual will die of cancer or that some other adverse environmental effect will occur), pollutant limits (e.g., 4.5 parts per billion of trichlorethylene), or prohibitions. This approach is used in part in the February 5, 1981, proposed regulations. See proposed 40 CFR 264.20, 46 FR 11161.

5. *Facility-Specific Risk Assessments Based on Narrative Standard.* This approach would establish broad narrative standards (e.g., no significant risk of cancer) and allow the permit writer to determine specific requirements after a full consideration of all the site-specific factors. This approach, like the one discussed in the preceding paragraph, is used in part in the February 5, 1981 proposed regulations. See proposed 40 CFR 264.21, 46 FR 11161.

IV. Risk Assessment: Predicting That any Release From the Land Disposal Facility Will be Environmentally Acceptable

As mentioned previously, EPA has reproposed land disposal standards which would require the permit applicant to predict the risk that a particular land disposal facility would impose upon human health and the environment and require the permit writer to review the application, independently determine the risks, and judge whether the risks are acceptable. This case-by-case approach has sometimes been referred to as "best engineering judgment" (BEJ). To distinguish this approach from other case-by-case "BEJ" approaches (e.g., a containment approach which requires the use of engineering judgment to determine the ability of a particular facility to contain particular wastes during the specified period), we will refer to this approach simply as "risk assessment."

A. General Approach

The basic approach of the reproposal is to create an initial presumption that no release of hazardous waste constituents to the water or air should be allowed. This presumption may be rebutted if, after a consideration of all relevant factors, the permit applicant demonstrates and the permit-issuing authority determines that no unacceptable effects on human health and the environment will result from any release from the facility. If only environmentally-acceptable releases will occur, then a permit may be issued. This approach thus contemplates that a

substantial burden will be placed on permit applicants to demonstrate that any releases from their facilities will not adversely affect human health or the environment.

The major steps in demonstrating environmentally-acceptable release are: (1) analyzing the hydrogeology, wastes and facility design; (2) predicting the rate and quality of leachate generation; (3) predicting the fate and transport of constituents leached from the facility to the unsaturated zone, the saturated zone and subsurface soil; (4) predicting the fate and transport of these constituents in the ground water (saturated zone); (5) predicting the fate and transport of gases and vapors which are released from the facility to the air; (6) predicting the exposures of people, animals, plants and other environmental components to released constituents; (7) calculating the total risk presented by the facility to human health and the environment; and (8) determining the acceptability of the calculated risk.

Predictions or calculations need not necessarily be expressed in single numbers. They may be statistical in nature (e.g., expressed in terms of means and standard deviations). This allows one to estimate risk while acknowledging the variability of the estimate. Qualitative estimates may be acceptable in extreme situations where the risks are clearly acceptable or unacceptable.

Many complicated and interlocking issues are inherent in the regulatory approach which EPA proposed on February 5, 1981. For manageability, EPA has broken the issues down into three broad areas of discussion: releases from the facility, migration of constituents in the environment, and human and environmental exposures and effects.

The issues are in most cases presented as a series of questions rather than in discussion form. EPA is interested in obtaining commenters' views. We have refrained from setting forth a detailed discussion of EPA's tentative or firm answers to the various questions. Where necessary to properly explain an issue, we have prefaced or supplemented the questions with some discussion.

In reviewing the technical questions, the reader will probably find that the answer varies depending on site-specific or waste-specific factors. Therefore, in answering the questions, commenters should clearly state their factual assumptions. Furthermore, commenters are encouraged to identify situations where predictions can be made relatively easily even when they are difficult to make with confidence in the general case. Similarly, commenters are encouraged to identify situations where predictions are relatively difficult to make even when they are easy to make with confidence in the general case. Both average and worst-case approaches to analyzing the confidence in making prediction would be useful.

The relationship of confidence in data or of predictions based on data to the cost of generating the data is important. For example, more extensive and expensive studies of local hydrogeological factors may yield greater confidence in predictions of the fate and transport of constituents in the ground. EPA encourages commenters to state how their confidence in predictions relates to cost. EPA also solicits comments on the ease or difficulty of developing the necessary data, including the time required to gather and analyze the data and the degree of expertise required to gather or analyze it. Also, EPA solicits comment on the current availability of such expertise as well as on the prospects for developing expertise through education and training where shortages exist.

A similar issue of confidence is the relationship of variability in data to variability in conclusions as to rates, velocities and concentrations of leached constituents. For example, mathematical models used to simulate contaminant plumes rely on series of equations which relate the many variables regarding the plume and its movement to one another. If one output of a model (e.g., concentration) is related exponentially or logarithmically to an input, it is possible that variability (or low confidence in prediction) of the output will be much larger or smaller than that of the input. In practice, the sensitivity of a particular output to a particular input is very complicated and may require several computer runs to be precisely determined. Moreover, different models incorporating different assumptions may yield somewhat different sensitivities. Therefore, EPA invites commenters to identify those factors whose variabilities either greatly or only minutely influence output (concentration or mass rate) variability and which therefore require a correspondingly large or relatively small data base. In short, we invite commenters to suggest which factors are most critical in plume migration models.

Finally, EPA requests that commenters consider management practices (e.g., waste separation) which could improve the reliability of predictions.

B. Releases from the Facility

In regard to surface-water and ground-water protection, the key concern is the mass rate (quantity per unit time) and quality of leachate produced at the facility. The following questions concern how leachate rate and quality may be predicted and managed at the facility:

1. What level of specificity of information must one have about the waste in order to predict the rate and quality of leachate produced? Is a detailed analysis of each waste's constituents required or will more general information suffice? Is prediction more easily made for particular classes of waste than others? How sensitive is prediction of leachate rate and quality to inadequate information on wastes?

2. a. What impact does disposing different wastes in the same cell or impoundment have on the reliability of predicting leachate discharge? How confidently can one account for reactions among wastes when predicting leachate quality? How sensitive is prediction of leachate rate and quality to errors in predicting such reactions?

b. How confidently can one predict the rates of decomposition of organic wastes and the most likely degradation by-products? How sensitive is prediction of leachate rate and quality to errors in predicting these factors?

c. Is it possible to confidently predict leachate quality by analyzing in detail the fate of a few representative or prominent constituents in the waste? What would be the most appropriate selection factors?

3. How sensitive is the prediction of leachate volume, rate and quality to errors in predicting water balance? How accurate are water balance methods and what are their primary limitations? Does the use of monthly averages for precipitation, evaporation, etc., provide reliable predictions? Under what circumstances will the moisture in the waste or the moisture resulting from decomposition of the waste be a significant source of liquid affecting leachate generation? Where these are significant, to what extent can one predict the contribution to leachate from moisture in the waste and moisture resulting from waste decomposition? To what extent can one predict subsurface migration of water into the facility? To what extent can one prevent such migration where the water table is high? Can prevention be maintained even after the facility is closed?

4. How sensitive is prediction of leachate rate and quality to correct and

precise analysis of clay liner materials, waste cells, and the unsaturated zone as to permeability, uniformity, moisture content, clay content and organic content?

5. With what confidence can one predict when leachate will first emerge from the waste? How sensitive is prediction of leachate rate and quality to errors in this factor?

6. How well can the following factors be accounted for in predictions of leachate rate and quality, and how sensitive are such predictions to these factors?

a. Differential settling of wastes (in a landfill) or of liner material;

b. Dessication of clay liners;

c. Degradation of synthetic liners;

d. Reactions between wastes and liner material;

e. Freeze-thaw cycles;

f. Contact time between waste and liquid; and

g. Other factors which lead to deviations of a facility from its routinely "expected" performance.

7. What costs and burdens are associated with predicting (calculating or estimating) each of the above-mentioned factors to the degree necessary to confidently predict leachate rate and quality? What type and degree of expertise is needed? How many experts among the regulated community and private consultants are currently qualified to perform such analyses? How capable are state regulatory agencies of reviewing and judging the correctness of such analyses? Where gaps in expertise exist, how much time is needed to close the gaps through education and training?

8. Which techniques are most useful for managing the rate and quality of leachate produced at the facility? EPA is particularly interested in comments concerning selective receipt of wastes, diversion systems, protective caps and waste stabilization and other pretreatment techniques. To what extent can these techniques be used to "fine-tune" leachate volume, rate and quality? For example, to what extent can these techniques be used to selectively reduce the concentration of particular constituents in leachate produced at the facility? For what constituents, or classes of constituents, are such techniques sufficient to achieve the required fine-tuning?

9. Given the absence of very long-term data, what confidence can we have that any particular management technique will, for a long period of time, result in the predicted leachate rate and quality? What is the risk that pretreatment reactions, sorption or other reactions may reverse themselves as the result of acid rain, microbial action or other factors?

In regard to air protection, the key concern is the mass rate and concentration of air emissions from the facility due to volatilization or wind dispersal. The following questions concern how air emissions may be predicted and managed at the facility.

10. What level of specificity of information must one have about the waste in order to predict the rate and concentration of air emissions from the facility? Is a detailed analysis of each waste's constituents required or will more general information suffice? Is prediction more easily made for particular classes of wastes than others? How sensitive are predictions of air emissions to errors in analyzing the wastes?

11. With what confidence can one predict the decomposition by-products of disposed hazardous waste which will volatilize or be dispersed by the wind? How sensitive are predictions of air emissions to errors in predicting the by-products?

12. With what confidence can one predict the upward migration of volatile constituents through the waste itself? How dependent is the prediction upon permeability, clay content, moisture content and organic matter content of cover materials?

13. How good is the present state of the art for monitoring and modeling emission rates of volatile compounds from land disposal facilities? What are the factors that may undercut accuracy in predicting the rates or concentrations of air emissions? How, if at all, can predictions account for such factors? (See, for example, the factors listed in question (f) above.) How sensitive are predictions of air emissions to errors in predicting these factors?

14. What costs and burdens are associated with developing adequate data with respect to each of the factors shown above to be necessary to confidently predict volume, rate and concentration of air emissions? What type and degree of expertise is needed? How many experts are currently qualified to do such analyses? What is the current capacity of state regulatory agencies to review such analyses?

15. Which techniques are most useful for managing the rate and concentrations of air emissions? EPA is particularly interested in comments concerning selective receipt of waste, protective caps, venting and treatment systems, and waste pretreatment. To what extent can these techniques be used to "fine-tune" the volume, rate and concentration of air emissions from the facility? For what constituents, or classes of constituents, can this "fine tuning" be accomplished?

16. Given the absence of very long-term data, what confidence can one have that a particular management technique will, for a long period of time, result in the predicted rate or concentration of air emissions?

Predictions of leachate or air emission characteristics require a substantial knowledge during the permit application process about the characteristics of waste which will be received at the facility throughout its operating life. It may be difficult for an owner or operator of a disposal facility, particularly a new facility, to have detailed knowledge about the wastes that he will receive. To what extent can a permit applicant predict the quality and quantity of waste that his facility will receive in the future?

C. Migration of Constituents in the Environment

In regard to surface-water and ground-water protection, the permit-issuing authority will need to know the extent of migration of waste constituents in the subsurface environment and in hydraulically-connected surface water. In addition, the permit-issuing authority will need to know the concentration of waste constituents at any affected point of ground-water use, which depends in turn on ground-water velocity and the extent to which the constituents diffuse, mix with ground water and are attenuated (e.g., degraded, sorbed, etc.). Furthermore, an analysis of the fate and transport of degradation products is required. The totality of possible events are referred to as "fate and transport" of constituents.

1. *Ground-water flow:* With what degree of confidence can we predict the direction and velocity of ground-water flow prior to contamination of the ground water by the leachate plume?

a. Are there certain types of geological systems (e.g., fractured strata or strata which may easily be dissolved) for which predictions of the direction of ground water flow would be too speculative to be made with any confidence? Where are such systems predominantly located?

b. Are there certain types of geological systems for which predictions of the direction of ground-water flow can be made with a high degree of confidence? Where are such systems predominantly located?

c. How good is the current state-of-the-art for estimating ground-water velocity throughout a hydrogeological

system which may receive discharges from a land disposal facility?

d. How is any prediction affected by the nearby presence of wells which are used for withdrawal or recharge of ground water by use of pumps or other means? How good is the state-of-the-art for calculating how far from such wells the leachate plume must be to remain relatively unaffected by the use or cessation of use of these wells?

2. *General movement of constituents in ground water.* If one ignores all attenuation, how well can one predict the transport of leachate constituents?

a. *Separation of phases based on specific gravity.* (i) *Heavy organics.* If a leachate plume contains organic constituents which are heavier than water, will those constituents form a separate plume which does not move with the ground water? If so, how well can we predict the direction and rate of flow of this plume? Which type of organic constituents are most likely to be part of this separate plume? With what precision must one know the leachate quality to determine the likelihood that such a separate plume will form?

(ii) *Light organics.* Answer for light organics the same questions as raised in Question (1) above.

(iii) Is the answer to questions (i) and (ii) dependent on the salt or mineral content of the ground water? To what degree?

b. *Molecular diffusion.* How well can we predict the degree of which the leachate plume will expand and concentrations of constituents will decrease by virtue of molecular diffusion?

(i) To what extent, if any, does this effect depend on the initial concentrations in the plume? Does the rate of diffusion differ for different constituents? To what degree?

(ii) To what extent does this effect depend on ground-water velocity?

c. *Dilution with ground water.* How well can we predict the degree to which constituents' concentrations will be decreased by virtue of mixing with the ground water? (Disregard the effect of plume separation discussed in Question (a) above.) How dependent is the dilution effect on ground-water velocity?

d. *Degradation of constituents.* To what extent can the following mechanisms be expected to cause the decay of constituents in the saturated zone? For what types of constituents, if any, is such decay likely to be significant? If not significant, can any fate equation or model ignore the degradation effect? If significant, how well can the effect be predicted, and how sensitive is any fate/transport prediction to error in predicting the degradation effect?

(i) Biological degradation—both aerobic and anaerobic processes.

(ii) Degradation by hydrolysis.

(iii) Degradation by photolysis.

(iv) Radioactive Decay.

(v) Destruction by reaction with other constituents in the leachate plume, ground water, or geologic environment.

(vi) Other.

e. *Sorption of constituents.* With what degree of confidence can the attenuation of constituents by sorption be predicted?

(i) How dependent is sorption capacity and rate upon factors such as soil particle size, organic content, porosity and cation exchange capacity? How much data concerning these factors is needed to characterize the geology and confidently predict sorption capacity and rate? Does sufficient expertise and equipment exist to make the required analyses?

(ii) To what degree is sorption enhanced by a low ground-water velocity?

(iii) How dependent is the sorption rate for a particular constituent upon the concentrations and sorption rates of the constituent or other constituents in the leachate plume? Is it likely that constituents would compete for sorption sites, or are enough sites available for all leached constituents within a short distance from the facility?

(iv) Is there any difficulty in assessing sorbability of particular constituents?

(v) What other factors, if any, are highly significant in predicting sorption rates?

(vi) How likely is it that sorption will be reversed over time? What factors are significant in promoting such reversal? In cases of potential reversal, how well can one predict the extent to which constituent concentrations will be altered by the sorption and subsequent desorption? In such cases, will the temporary sorption have reduced constituent concentrations through a retardation effect? How well can this be modeled?

f. *Attenuation or retardation by means other than sorption.* Are any mechanisms other than sorption significant enough and predictable enough to be evaluated in predicting attenuation of constituents? (Consider, e.g., ion exchange and precipitation.) How reversible are these mechanisms?

g. *Simplified approaches.* Where knowledge of the leachate quality entering the ground water is highly uncertain, what simplified approaches can be used to characterize plume migration?

(i) Can particular constituents known to be prominent constituents in the leachate be selected for analysis as representative of all constituents? (For example, select one or two metals, organic acids, organic bases, neutral polar organics and neutral non-polar organics.) What factors would one apply to determine representativeness? Chemical structure? Mobility? Toxicity? Concentration in the leachate?

(ii) Rather than select representative constituents, could "worst-case" highly mobile constituents be selected to determine the maximum mobility of all constituents? Going one step further, is it reasonable, in light of data and modeling difficulties, to not consider attenuation and degradation and only consider dispersion and ground-water mixing?

h. *Summary on water quality.* Is it possible to predict the concentration of constituents in the ground water even within several orders of magnitude? Is the answer dependent on a detailed knowledge of leachate quality? Can qualitative predictions suffice for some situations? Can worst-case analyses be used to assure acceptability of facilities? Is there an adequate supply of trained professionals to make these predictions and to evaluate them? If not, how much time is needed to develop the supply through education and training?

i. *Air quality.* In regard to air quality protection, the permit-issuing authority will need to know the extent of migration of waste constituents as well as the concentration of waste constituents at points of exposure. The following questions concern how migration of waste constituents in the air may be predicted:

(i) What level of specificity of information must one have about waste constituents and reactions among them in order to predict dispersion in the air?

(ii) What information must one have about patterns of air circulation and weather to predict migration in the air? How can the dynamic character of air circulation be accounted for in predictions of waste migration? To what extent can averaging fluctuations over long periods of time increase confidence in predicting impacts of air emissions upon ambient concentrations?

(iii) What costs and burdens are associated with accurately predicting waste constituent migration in the air? How advanced is the technology for collecting data to verify predictive models? What type and degree of expertise is needed? How many experts are qualified to do such analysis? Is the current state-of-the-art advanced enough to allow predictions of short-term concentrations relevant to determining acute effects, or are they

capable of dealing only with long-term averages?

3. *Miscellaneous Questions.* a. The approach of calculating and assessing risk requires, at a minimum, some knowledge of the concentrations of waste constituents in the vadose zone. In meeting its goal of protecting human health and the environment, EPA must decide whether the regulations should protect the vadose zone *per se.* For example, should the regulations prevent contamination of the unsaturated zone to assure that future uses (e.g., housing development or farming) in the area will not be affected by later migration within the unsaturated zone? This issue is important because it affects one's ability to use the natural soil below the facility as part of his leachate control system.

b. This approach involves prediction of waste constituent migration to points of ground-water use. What is an appropriate "point of use" for purposes of regulation? For example, in considering ground-water use, should the point of use be the home tap or the cone of depression surrounding a withdrawal well?

c. The rates and directions of ground-water movement and of contaminant plumes depend to a large extent upon gradient (the driving force for the movement). Gradient can be radically altered at a particular location by inducing changes in the vicinity such as ground-water pumping, cessation of pumping, discharge or recharge. Should and can an owner or operator be required to negotiate agreements with neighboring landowners to assure that they will not take actions which could significantly alter the gradient in that portion of the ground water which may be reached by the contaminant plume? If not, what confidence can be placed in predictions based on the assumption that ground-water flow patterns will remain unchanged over long periods of time?

D. Assessing Exposures and Effects

The following questions apply to the methodology of assessing risks from both air and water polution. The acceptable level of risk may be established in national regulations or in site-specific proceedings on individual permits. Wherever made, however, the determination of acceptable risk requires a consideration of the following questions, and EPA is interested in public comments on them. In formulating their responses, commenters should distinguish, when appropriate, between these two avenues for adverse effects.

1. What assumptions can one make about future ground-water and surface-water use and of future land-use patterns in order to predict future exposures?

2. What factors are most likely to undercut the accuracy of a prediction about environmental exposures? What range of uncertainty do they cause?

3. What degree of confidence can one attain in predicting environmental exposure? (Commenters may want to answer this question by indicating the range of error that might be expected in prediction.) To what extent does the absence of particular data significantly alter confidence in the prediction? Are there particular wastes or environments for which no confident prediction can be made? Identify these wastes or environments.

4. What costs and burdens are associated with accurately predicting near and long-term exposures? What type and degree of expertise is needed? How many experts are qualified to do such analysis?

5. What, if any, simplifying assumptions can one use to reduce the cost and burden of these predictions? How do assumptions affect the confidence in the prediction? Can a "worst-case" scenario be developed which provides high confidence that predictions of exposure to and adverse effects from waste constituents have not underestimated the significance of the effect?

6. Once the probable exposures to waste constituents are estimated, what methodologies are appropriate to predict human health effects? Consider effects such as acute toxicity, chronic toxicity, carcinogenicity, mutagenicity and teratogenicity. Consider Federal and State regulatory requirements (e.g., National Primary Drinking Water Standards under the Safe Drinking Water Act; toxic standards under the Clean Water Act; and National Ambient Air Quality Standards under the Clean Air Act); published, non-binding criteria (e.g., EPA's Water Quality Criteria and ACGIH's and OSHA's Threshold Limit Values); and published studies (e.g., by National Cancer Institute).

7. When published regulations, criteria or well-documented studies are unavailable, what is the cost of conducting tests adequate to demonstrate probable health effects? Are any screening mechanisms (e.g., Ames test) reliable enough to demonstrate that further testing is unnecessary (because the test results are either strongly positive or strongly negative)?

8. What methodologies, regulations, criteria or studies are appropriate for predicting environmental effects other than human health effects?

9. Does the state-of-the-art enable one to predict synergistic and antagonistic effects of several toxic or carcinogenic constituents?

10. In predicting human health effects, should EPA consider the number of people affected by exposure to waste constituents or should it focus on protecting any individual against a predetermined probability of risk? For example, should the level of "acceptable" contamination depend on the number of persons likely to be exposed to the contamination?

11. Should the EPA make assumptions about rates of ground-water use or should rate of use be determined on a site-specific basis, based on evidence submitted by the permittee? If commenters believe that assumptions about use are appropriate, they should suggest appropriate assumptions.

12. Even where a thorough analysis has been done, uncertainty may remain about what land-use patterns around a disposal facility are likely to be in the future. Where such uncertainty occurs, what presumptions should be made about future avenues of exposure?

13. In defining likely exposure levels, should the permit-issuing authority make any assumptions about whether water would be treated prior to consumption? If so, what assumptions should he make?

14. Should the risk calculations be aimed at the "normal" individual or should allowances be made for sensitive populations?

15. Should the permit-issuing authority apply a "margin of safety" when defining risk, particularly when the data on adverse effects is limited? What "margins of safety" should be applied?

16. What level of risk should be considered acceptable by the permit-writing authority or regulation-writing authority?

17. Should the regulations be concerned with the incremental risk posed by a facility or with the combined risk posed by the facility together with background concentrations? If the former, should background concentrations be considered at all? How does the answer to this question depend on the shape of assumed dose-response curves? If the latter, should any incremental risk be considered acceptable, provided that its combination with background yields an "acceptable" risk?

18. Should the regulations be concerned with distribution of risk by promoting the siting of facilities in areas where background concentrations are low? Is it inequitable to impose greater risks on some populations than others,

or does the freedom to move overcome any potential inequity?

V. Containment Approach to Land Disposal

The principal alternative to the risk assessment approach which EPA has considered to date has been the "containment" approach. In its original proposed rules of December 18, 1978 (43 FR 58946), EPA proposed the use of specific design and operating standards. As stated in the Preamble, the goal of those proposed regulations was "to prescribe design and operating standards which will provide maximum containment."

In the supplemental notice of proposed rulemaking issued on October 8, 1980, EPA outlined the major alternative approaches to land disposal being considered at that time. A containment approach was specifically discussed in that notice. Unlike the proposed rule, however, the supplemental notice presented the containment approach as a technical performance standard that would allow permit applicants to use various design and operating measures as long as they could demonstrate that the containment objective would be achieved.

EPA rejected the containment approach in its February 5, 1981 reproposed regulations because, while this approach can provide maximum environmental protection for a finite period, it does not, taken alone, address the environmental impact which will occur after the containment system is finally breached. For that reason EPA required in its reproposed regulations a site-specific assessment of both the short-term and long-term risks presented by a land disposal facility to human health and the environment.

A. General Approach

A containment approach would require that waste constituents not migrate beyond some boundaries within some period of time. In order to obtain a permit an applicant must demonstrate that the particular design and operating measures which he intends to use would achieve the specified containment goal.

Several variations of the containment approach are possible. First, the containment requirement may be limited to particular constitutents. For example, one could identify a set of high-risk constituents that must be contained in a facility for a certain period of time while ignoring the release of other components of the waste which may be more mobile but less toxic. Second, the boundaries for a containment zone could vary. Regulations could require containment within the facility or within a larger area around the facility, allowing some limited degradation in that area (*e.g.*, to the property boundary). Third, the time period for containment can vary (e.g., 50 years, 100 years, or 500 years). While a containment approach does not necessarily anticipate that all of the wastes in the facility will flush out of the facility once the containment period ends, it does imply that some quantity of waste material will begin to enter the environment after the containment period ends.

There are many approaches to designing a land disposal facility to contain wastes for a specified period. Although the reliability of most approaches is imperfect, the following factors generally will help contain the wastes:

1. Minimize exposure of the waste to water which would leach constituents out of the waste by, for example:

a. Locating in an arid area;

b. Preventing run-on of water from surrounding areas;

c. Placing the facility above the water table; and

d. Covering the facility, at the time of closure, with a highly impermeable cap.

2. Minimize the exit of leachate from the facility by use of leachate collection system.

The discussion below focuses on containment with respect to all environmental media except air. While this notice poses some technical questions about the applicability of the containment model to air emissions, EPA recognizes that it may be impossible to contain air emissions from certain land disposal facilities. (For example, it is not possible to completely contain volatile organic constitutents in surface impoundments. If such volatilization is considered a problem, pretreatment rather than containment would be appropriate.) Therefore, most of the discussion of containment will deal with prevention of discharges to soil, ground water and surface water.

B. Question

1. *Predicting Containment Life of a Particular Land Disposal Facility.* In a typical land disposal facility designed for containment, one would perform at least the following basic steps to estimate containment life:

a. Predict leachate generation by using water balance methods. These methods incorporate estimates or assumptions concerning precipitation and evaporation rates in the area of the facility runoff; vegetative cover which could contribute to transpiration of water from the facility; and permeability and thickness of soils and any liner overlying the waste, which indicate the extent to which contact of water with the waste will be prevented, thereby preventing leachate production. (For further information, see Tenn, D. G., K. J. Hanley and T. V. Degeare, *Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites,* EPA/630/SW–168 (1975), US–EPA, Cincinnati, Ohio; and Perner, E. R. and Gibson, A. C., *Hydrologic Simulation of Soild Waste Disposal Sites,* SW–868 (draft, September 1980), US–EPA, Cincinnati, Ohio.)

b. Predict when leachate causes any liner material beneath the waste to reach field capacity, after which any addition of leachate to the liner would result in the discharge of leachate through the bottom of the liner. This prediction involves analyzing the rate of leachate production (based primarily on the factors listed in paragraph (a) above), the efficiency of any leachate collection and removal system above the bottom liner, and the thickness, permeability and life (generally assumed to be 20 or 30 years) of any synthetic liner underlying the waste. (For further information, see Moore, C. A., *Landfill and Surface Impoundment Performance Evaluation Manual,* SW–869 (draft, September 1980), USEPA, Cincinnati, Ohio.)

In examining the appropriateness of a containment approach, EPA believes it is important to consider the uncertainties that arise in predicting the time of initial release and the rate of leachate migration into the environment. EPA, therefore solicits comments on the following questions:

i. Assuming that a water balance uses historical monthly net precipitation rates, how sensitive is the prediction of leachate generation rates and leachate containment periods to errors resulting from the inability to account in advance for catastrophic or unusual storm events occurring before or after closure of the facility? Are these factors significant in the case of surface impoundments or only in the case of landfills?

ii. How can one be assured that cap seepage due to dessication cracks, root channels, and channels caused by rain and freeze/thaw cycles will be completely prevented during a specified period? At what cost?

iii. How can one be assured that differential settlement (caused by waste consolidation) which causes cracks or slope slip will be completely prevented?

iv. How can one be assured that shrinking and swelling of caps or clay liners due to changes in moisture content will be prevented, thereby preventing channelization?

v. How detailed a knowledge must one have of the wastes which will be disposed of at the facility to assure that waste/liner reactions will not result in liner breaches (e.g., cracks in clay liners or degradation of synthetic liners) or increases in liner permeability? What, if any, waste/liner combinations (e.g., solvents and clay liners) should be banned in order to prevent premature discharge from the facility?

vi. What costs and burdens are associated with accurately predicting containment life of a disposal facility? How are the costs and burdens of predictions affected by variations in the factors identified in a–e above? For example, at a commercial facility which receives a variety of wastes, what costs (e.g., waste analysis) and burdens (e.g., modifications of predictive models) are needed to account for any incompatibility between the waste and the facility liner?

2. *Managing Land Disposal Facilities to Assure Containment.* The longer one wishes to contain waste, the more difficult the task becomes. Synthetic liners and caps will degrade; soil liners and caps may erode and crack. Therefore, it is assumed that some type of monitoring, inspection and maintenance program will usually be necessary to assure containment, even with a facility design that is expected to achieve long-term containment. EPA, therefore, solicits comments on the following questions:

a. Have any liner or cap designs been demonstrated to achieve long-term (e.g., greater than 25 years) containment without maintenance? EPA is not aware of any field data showing successful long-term containment of waste at facilities which have not been maintained over time. EPA urges commenters who are aware of such facilities to provide all relevant data (including ground-water monitoring information) about such facilities.

b. Under what conditions is it technically feasible to replace a cap? Can a cap be replaced without disrupting a landfill in a manner that accelerates leachate generation or release from the facility?

c. The roots of vegetation grown in the soil above a cap can penetrate the cap, creating channels which allow water to enter the facility. Assuring long-term containment, therefore, will generally require an ongoing vegetation management program by the facility owner or operator. What, if any, measures can be taken to reduce this responsibility? EPA is particularly interested in landfill design measures which have been demonstrated to obviate the need for vegetative management programs while achieving containment.

d. Are there any proven methods besides ground-water or leachate monitoring for detecting failure of a containment design? For any such alternative approach, commenters should describe any field experience with the technique.

e. Can a leachate detection system (e.g., collection and removal system below the liner) operate efficiently for long periods of time (e.g., 100 years)? What methods are available to unclog a leachate detection system? EPA urges commenters who address this question to report on any field experience with maintenance of leachate detection systems.

f. How often must ground-water monitoring equipment be replaced? What costs are associated with long-term maintenance of monitoring equipment? EPA is particularly interested in field demonstration of useful life of monitoring equipment.

3. *Subsequent Management of Buried Waste.* One rationale advanced in favor of a containment approach is that some time in the future, once waste management technology advances and the cost of resources increases, it may become reasonable to retrieve, treat or reclaim wastes that have been placed in land disposal facilities. This argument suggests the following questions:

a. Under what conditions is it now technically feasible to recover buried waste material? What risks are placed on those who exhume such material? Can commenters cite examples where waste recovery has been successful?

b. What design and operating measures can be taken in disposing of wastes today to facilitate their removal some time in the future?

c. What design and operating measures can be taken in disposing of waste today to facilitate in-situ treatment some time in the future?

4. *Containment with Respect to Air.* Organic chemical wastes placed in landfills, land treatment facilities and particularly surface impoundments may volatilize in the air. Metal wastes in most cases are not emitted in substantial volumes from land disposal facilities (except perhaps as particulate matter dispersed by the wind.)

Some measures are available to control air emissions. In landfills, sorption, biodegradation and other mechanisms may limit the amount of organic waste which may be volatilized. Cover may be used to limit the rate of migration of vapors or water rising to the ground surface where vapors may be released to the air. Furthermore, in a manner analogous to leachate collection systems, gas collection systems may be used to collect vapors and direct them to treatment systems (*e.g.*, burning or sorption). In surface impoundments, emissions may be substantially reduced by covering the surface with oily film. However, this interferes with aerobic processes, which are important for certain treatment processes in impoundments.

The containment approach has not generally been applied to air emissions. EPA solicits comments on whether containment approach is technically feasible for air emissions from land disposal facilities. In discussing this issue commenters are urged to consider whether a containment approach is feasible for particular facilities or waste types.

5. *Miscellaneous Questions.* a. The containment approach is one which provides maximum protection for a finite time period. One of the fundamental questions it raises is the attitude which should be taken toward risks that may be presented by releases to the environment occurring after the containment period. Any of the following approaches could be used:

i. Assume that any risks posed by the facility after the containment period passes are minimal or may be ignored for other reasons.

ii. Assess the risk to future generations caused by discharges from the facility, using the risk assessment methodology discussed in Section IV above. Such an assessment would involve predicting the quantity and quality of the discharged leachate, the degree to which people and the environment would be exposed to the discharge (which requires, for example, an assessment of future withdrawls and uses of ground-water near the closed facility), the risks which would result from those exposures, and future generations' technical and economic capability to avoid or minimize those risks through aquifer restoration or other methods.

iii. Require certain practices, such as leachate collection, to minimize leachate discharges. Some of these practices could be imposed during as well as after the containment period to minimize the post-containment discharges.

Commenters who favor using the containment approach should address the post-containment period issue, since its resolution is critical to any justification of a regulatory scheme based on containment. In addition, commenters should indicate their responses to issue A in section II of this notice, together with their views as to an appropriate containment period.

b. A closely related issue concerns the assumptions one makes about the likelihood of future waste management technology that will allow for retrieval, treatment or recycling of waste being placed in land disposal facilities today. One rationale for a containment approach may be an assumption that future generations will have the ability to better manage and prevent environmental damage from wastes being disposed of by today's society. Is that a reasonable assumption? Obviously, EPA does not except commenters to be omniscient. However, EPA does ask commenters who favor the containment approach based on this rationale to at least identify the current evidence which makes the assumption reasonable.

c. What is an appropriate containment zone? Should all wastes be contained within the facility (including its liner system)? Should the zone be extended to include the unsaturated zone or the facility property line?

VI. Alternatives to the Modifications of the Risk Assessment and Containment Approaches

Sections IV and V have set forth the two major alternative regulatory approaches which EPA has considered. The risk assessment approach attempts to define and then achieve an "acceptable" risk at each facility, while the containment approach seeks to attain a zero-risk level for a fixed period of time. While these two are reasonably comprehensive, there are good reasons to consider other approaches to replace, supplement, or modify either of these two basic approaches.

First, either approach involves many technical and institutional uncertainties. The present state of knowledge in designing facilities to contain wastes for long periods of time is limited, as is the ability to perform risk assessments. It is unclear whether the necessary institutions to prevent long-term risks can be established and maintained. Limited expertise, time and money further constrain our nation's ability to carefully design, assess, monitor and maintain each land disposal facility.

In light of these problems, it may properly be argued that both the risk assessment and containment approaches are inadequate. Some may argue that supplementary or alternative technical requirements are necessary in at least some situations. Others may argue that, for particular locations or wastes, the short and long-term risks created by land disposal facilities are so great that land disposal should not be allowed at all.

Second, it may be argued that particular alternatives to land disposal are environmentally superior and should be encouraged by restricting the permitting of landfills. For example, some have suggested that disposal of certain types of wastes in the deep portions of the ocean may be safer than land disposal. Still others may argue that no disposal is demonstrably safe and that treatment techniques should be encouraged to destroy wastes or allow their safe reuse. Ultimately, waste reduction and resource recovery probably provide the best alternative to land disposal. Some may contend that EPA's land disposal regulations should be designed to foster these alternatives.

Finally, it may be argued that some areas of the country need greater or lesser protection. On one hand, some areas may be so polluted or remote that they cannot or need not be protected. One may contend that such areas should be identified through federal or state rulemaking. Under a containment approach, requirements to contain wastes might then be waived in those areas. Under a risk assessment approach, an automatic assessment of no incremental risk might be made, thereby saving the time, expense and expertise otherwise needed to conduct a detailed risk assessment. On the other hand, some may contend that certain areas are entitled to absolute protection and that no facilities should be allowed in those areas regardless of how they are designed and how minimal their assessed risks appear to be.

EPA believes that these issues should be carefully considered in formulating a comprehensive policy on hazardous waste land disposal. EPA, therefore, solicits comments on alternatives to the risk assessment and containment approaches. The following discussion is designed to stimulate comment on these issues. Where an issue depends on particular facts, EPA requests that commenters submit relevant data together with their discussions of broad policy issues.

A. Supplementary or Alternative Design and Operating Requirements for Land Disposal Facilities

As mentioned above, a variety of factors may suggest that our current ability to achieve either a containment goal or an acceptable risk goal is uncertain. Therefore, it may be appropriate to provide an additional margin of safety by specifying particular design standards or operating practices.

One standard that might be applied is the required use of a leachate collection system which provides a specified minimum level of efficiency of removal. This would undoubtedly be a major feature of many facilities even without a regulatory requirement. However, for a facility which otherwise would not have a leachate collection system, this requirement would provide an additional margin of safety by lessening the amount of leachate which could exit through the bottom of the facility. This is especially important if a facility ultimately fails to contain or control the discharge of leachate as well as its permit requires.

A second set of standards, similar to those now contained in EPA's interim status regulations, are designed to limit the amount of liquid in a facility and thus minimize leachate generation. Such requirements might include the control of entry of liquids into landfills by the prevention of run-on, the collection of run-off, and keeping wastes containing or likely to produce (as a decomposition byproduct) free liquids out of landfills. For surface impoundments, an analagous requirement is the removal of standing liquids at the time of closure. On one hand, some may contend that in some situations (e.g., certain arid areas), these requirements are not necessary and should be subject to case-by-case determinations during permit proceedings. On the other hand, some may contend that the additional margin of safety provided by liquids controls are needed to protect against unforeseen circumstances (e.g., unusual storm events) and assure long-term protection of public health and the environment.

A third possible set of standards would involve requirements for liners above and/or below the buried wastes. The purpose of such requirements would be to delay or slow the rate of leachate generation and discharge. As in the case of the requirements mentioned above, arguments may be presented to oppose a requirement of liners as unnecessary in some instances or to support it as a necessary safety measure in all cases.

A fourth set of standards might require permittees to pretreat wastes prior to land disposal. To some extent, this may amount to a ban on disposing certain types of wastes in landfills. One example is banning wastes which contain more than a certain level of cyanide; this would in effect require cyanide destruction prior to land disposal. Another requirement might be to prohibit the codisposal (disposal in the same landfill cell or surface of impoundment) of certain wastes. Examples of waste combinations which could be regulated are acids with metals and solvents with certain highly toxic aromatic hydrocarbons. Finally, requirements for stabilization,

solidification or encapsulation of particular wastes might be required to reduce their leachability or mobility.

A fifth set of standards might require permittees to install equipment to control air emissions from landfills. For example, the regulations could require a gas venting system that channels air emissions to particular facilities where the vapors may be treated. Commenters who favor such a requirement are urged to discuss and recommend what performance standards might be appropriate for control of collected gases. For example, should land disposal operators achieve a destruction and removal efficiency comparable to that required for incineration of certain organic hazardous waste constituents, for any air emissions from its collection and treatment system?

In addition to using design standards to supplement a risk assessment or containment approach, they may be used independently where neither of the two approaches are deemed adequate, for the reasons discussed above. Thus, a set of minimum design and operating requirements could constitute a separate regulatory approach.

EPA requests that commenters favoring any of the above requirements as supplements to other approaches or as independent approaches explain fully why they are necessary and specify as much as possible what the requirements should be. Information on the reliability and cost of the suggested requirements should also be submitted. Commenters opposing particular requirements are urged to provide specific examples of situations where the requirements clearly would not be necessary to provide safety margins. EPA also welcomes comments suggesting further specific requirements which are not discussed above but which may be appropriate.

B. Requiring Selection of the Best Management Alternative

Several alternatives to land disposal are already used nationwide or in particular regions of the United States. These include incineration (including incineration-at-sea), thermal treatment, certain types of chemcial, physical and biological treatment, and ocean disposal. In addition, there are several alternative forms of land disposal (landfilling, placement in surface impoundments, land treatment and underground injection).

Many new hazardous waste treatment and disposal techniques are being studied or developed at present, and some may be expected to prove superior to land disposal for at least certain types of wastes in the future. A brief summary of some of these emerging technologies and a list of references for further information are provided in Booz, Allen & Hamilton, Inc. and Putnam, Hayes & Bartlett, Inc., *Hazardous Waste Generation and Commerical Hazardous Waste Management Capacity—An Assessment*, Appendix J ("Emerging Hazardous Waste Treatment and Disposal Technologies"), December 1980.

In addition, many of the existing technologies which currently handle only certain types of wastes may become able in the future to handle broader classes of wastes. For example, rotary kilns can incinerate more types of wastes than the more prevalent liquid incinerators can. As more rotary kilns become available, more types of wastes can be incinerated.

While it is premature to direct wastes away from land disposal facilities to technologies which are not yet available, one can at least direct wastes away from land disposal facilities when environmentally superior options are available. Under this approach, each operator of a particular type of land disposal facility, as part of the permit application process, would be required to demonstrate that no environmentally superior treatment or disposal option is available for handling the wastes in question. (Some states have begun to use this approach.)

This approach raises several issues. EPA asks commenters who address this alternative to consider the following:

i. How should the relative environmental merits of competing alternatives be judged? Can quantitative assessments of risks presented by each option be made in a manner that allows for quantitative comparisons between alternatives or must the permit writer ultimately make a comparison based on qualitative judgment alone?

ii. How can this approach account for the distribution of risks among the population? Various alternatives will present differing degrees of aggregate environmental risk. In addition, each alternative presents risk to differing groups of people and portions of the environment. Should any alternatives analysis consider the distribution of risk? If so, how?

iii. How should EPA determine that an alternative is "available" under this approach? Is this a question of technical feasibility or one that considers cost? How should cost be used in determining the availability of an alternative?

A broader approach for comparing environmental alternatives would be for EPA or a State agency to broadly assess various types of waste management techniques and the classes of waste for which they are most appropriate, considering technical, risk and cost factors. This type of effort is very difficult. However, EPA solicits suggestions on preferred options for particular types of waste.

C. Requirements Concerning Location

An additional approach which may be used to supplement or modify the risk assessment, containment, technical standards or alternative options approaches is one which allows broad regulatory decisions to be made with respect to particular locations.

Neither a containment approach nor a technical standards approach explicitly considers locational factors except as they relate to technical considerations such as local precipitation and evapotranspiration rates. The risk assessment approach does consider location on a case-by-case basis. However, it does not necessarily involve a general designation of geographical regions as acceptable or unacceptable locations for land disposal facilities. It is therefore appropriate to examine whether any specific provisions concerning location should be included in national hazardous waste regulations.

Several factors might be relied upon to justify placing land disposal facilities in particular locations. First, the ground water in an area may already be so contaminated by nature or by man as to be unsuitable for uses which could result in human exposures. Second, the area may be so remote that human exposures to buried wastes are unlikely at present and for the foreseeable future. Finally, it might be desirable to designate particular areas as waste sinks, provided that they are isolated from the public, to relieve the pressures for permitted waste disposal sites (or illegal disposal practices) in other areas where public exposure would be more likely to occur.

Several arguments, however, may be presented against encouraging land disposal at particular locations. First, the availability of a cheap land disposal option discourages the development and increased use of waste recycle and reuse, destruction and treatment. Second, as future water quality and quantity needs and land use patterns change, areas which are designated waste sinks today may be needed by future populations. Third, few areas are so remote that animals and plants cannot be placed at significant risk from unregulated waste disposal practices. Fourth, over long periods of time, ground water can move from a remote area to a less remote area. In some cases,

persistent constituents may migrate a significant distance from the waste burial site.

Several factors might be relied upon to justify prohibiting the location of land disposal facilities in particular areas. First, some areas may be so heavily populated that even a small risk that waste will be released to the environment may, when multiplied by the potentially exposed population, result in a significant risk to society. Similarly, areas underlain by ground water which is now or is likely in the future to be used for drinking water may deserve special protection. Third, environments which are sensitive to contamination (e.g., wetlands or areas with shallow water tables overlain by sandy soil) may deserve special protection.

An argument against banning land disposal facilities from particular locations is that facilities that might be designed to prevent unacceptable risk would be unfairly banned. This could create some hardship, particularly for existing generators in such areas who currently rely upon on-site disposal in landfills or on-site wastewater treatment in surface impoundments.

EPA recognizes that explicit regulation of location of hazardous waste land disposal facilities is a sensitive issue and believes that any such regulation should be carefully considered. EPA, therefore, urges commenters to provide any information relevant to this issue. What criteria should be applied to designate locations as waste sinks or waste-free zones? Can examples be provided of areas that might appropriately be designated as waste sinks or waste-free zones?

D. Prohibiting Land Disposal (Treatment and Long-Term Storage)

Given the current state of knowledge about hazardous waste management, some may contend that the risks of land disposal are too great to be borne. They might suggest that the land disposal of hazardous waste should be banned. Even if a ban is not imposed for all wastes, it may be unnecessary to assume the risks associated with land disposal of hazardous wastes for those wastes for which treatment (e.g., incineration) is now available. EPA invites commenters to suggest how this approach might be used and to identify those waste types which can be adequately treated with available technology.

In addition, it may be possible to safely store certain wastes above ground for long periods of time, avoiding the need for disposal with current technology. For example, it is possible to store liquid wastes in tanks and to completely contain them for 10, 20 or 30 years depending on design and maintenance. Indeed, storage tanks are already used for this purpose, although the contents of the tanks may be changed frequently. It should be possible to construct above-ground vaults to store various other wastes for significant periods of time.

If long-term storage is practicable, it could provide a bridge between any current shortage of environmentally-acceptable alternatives to land disposal and future capacity to handle today's excess wastes. This would allow a regulatory strategy which phases out at least some land disposal practices even where adequate treatment or disposal alternatives do not yet exist. It could also provide society more time to improve land disposal techniques and to develop a regulatory strategy for land disposal which is acceptable to the public.

EPA solicits public comment on the use of a long-term storage strategy for hazardous wastes. EPA is particularly interested in public comment (with appropriate data) identifying the particular wastes or waste types that should be placed in long-term storage and the types of storage facility designs that would be appropriate, together with associated costs of storage as well as of ultimate removal for treatment or destruction.

VII. Existing Facilities

A. Regulatory Approach to Existing Facilities

EPA is concerned about the problem of permitting existing land disposal facilities. At present, thousands of landfills and surface impoundments which dispose or treat hazardous waste are operating with interim status under section 3005(e) of RCRA. All of these require permits to be issued under the Part 264 standards.

The interim status standards promulgated on May 19, 1980, which contain certain minimum operating and ground-water monitoring requirements, should result in the improved operation of facilities and the identification of significant ground-water contamination. In addition, the closure and post-closure requirements and financial responsibility requirements promulgated on May 19, 1980, and January 12, 1981 should help assure proper closure and post-closure care of these facilities. Furthermore, the worst existing practices may be stopped under the authority of section 7003 of RCRA, which allows the EPA Administrator to sue in Federal court to restrain any hazardous waste management activity that may present an imminent and substantial endangerment to health or the environment. Section 3008 of RCRA provides further enforcement authority by authorizing EPA to issue a compliance or order to commence a civil action for appropiate relief, including a temporary or permanent injunction for violations of the regulations which have been promulgated to date under Subtitle C of RCRA, and by subjecting any person who knowingly commits certain types of illegal acts to criminal penalties, including a fine, imprisonment, or both. Finally, the recently-enacted Comprehensive Environmental Response, Compensation and Liability Act of 1980 has established a fund (commonly referred to as "Superfund") to help finance cleanups or other appropriate responses to the worst environmental emergencies.

While the interim status regulations and section 3008 and 7003 actions can go a long way toward addressing the problems presented by existing facilities, these two mechanisms are ultimately somewhat incomplete. On one hand, the interim status regulations, for example, do not address directly the complex issue of how EPA will protect ground water and air. On the other hand, compliance orders and lawsuits cannot be used to address the large number of existing land disposal facilities.

The first problem relating to existing facilities is that a large number of them exist and are potentially presenting human health and environmental risks. The Agency invites comments on the most efficient means for addressing this large number of existing facilities.

A second problem related to existing facilities is that many of them would need to be retrofitted to comply with EPA standards. Retrofitting may be more expensive than building a new facility. If land to build a new facility is unavailable, an existing facility may find it difficult to meet the permitting standards. The problem may be particularly acute for some facilities that rely upon on-site surface impoundments to treat their wastewater. Yet, many surface impoundments have in the past created significant risk to public health and the environment. Thus, upgrading these facilities will be necessary in some cases despite the costs.

Several options are available to balance the need to upgrade unacceptable facilities against the desire to avoid imposing unnecessary burdens on acceptable facilities.

One approach would be to conduct a detailed risk assessment at each facility.

This would assure that appropriate requirements are set for each reviewed facility. However, as noted above, this procedure would consume time and resources and could slow the permitting of many facilities. *See* 46 FR 11134 (February 5, 1981).

A second approach would be based on reviewing ground-water monitoring results under Part 265 Subpart F of the interim status standards. For example, one might impose additional requirements only on those facilities which appear to have leached any or some designated level of constituents to the ground water. A refinement of this approach would be to use the monitoring results to trigger a second and more detailed level or review prior to imposing particular requirements.

A variation on the second approach would be to first address those facilities which have already affected the ground water as a matter of first priority. After those facilities have been issued or denied permits, a more detailed assessment of the other facilities could be made to determine their future potential for creating risk and the need to require particular design or operation modifications.

EPA solicits comments on these options for handling existing facilities as well as on any strategies not mentioned above.

B. New Cells at Existing Facilities

EPA is also concerned about how to regulate new cells and impoundments at existing facilities. A "facility" is defined in 40 CFR 260.10 as "all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage or disposal operational units (*e.g.*, one or more landfills, surface impoundments, or combination of them)." Thus, it is possible to have several cells or impoundments at a single facility. Where a new cell or impoundment is constructed at an existing facility, it may or may not involve retrofit problems of the sort discussed above, depending on the extent to which it is integrated with the previously existing cells or impoundments. However, EPA could, as a matter of policy, prohibit the connection of new cells and impoundments to existing structures if the connection would impede imposition of all necessary requirements.

Should EPA assess the extent to which new cells and impoundments are integrally connected to existing structures before imposing requirements? Or should EPA subject new cells and impoundments to the same requirements as new facilities?

VIII. Comparison of Alternatives

The previous three sections have explained the principal alternatives available for regulation of hazardous waste land disposal. EPA urges public commenters to compare these alternatives and provide their opinions on which approach, or combination of approaches, provides the most effective regulatory scheme. EPA is, of course, interested in the public's opinion on the relative advantages and disadvantages of the risk assessment approach. If commenters raise objections to that approach, however, EPA asks them to identify an appropriate alternative regulatory scheme and explain why it is preferable.

To assist in the comparison of alternatives, EPA suggests that commenters address the following questions:

1. As indicated earlier, public confidence is dependent on a belief that EPA's regulations deal comprehensively with the environmental effects of hazardous waste and that the measures required by a permit are reasonably certain to provide the level of protection desired. Which approach is most likely to provide comprehensive consideration of all relevant effects of hazardous waste? Which approach provides greatest certainty that its proposed goal will be reached, particularly for long periods of time?

2. Whatever their theoretical approach, EPA's hazardous waste regulations must be capable of being implemented. This means that the expertise must be available to do the technical analyses required and that permit decisions must be deliberate but not unnecessarily time-consuming. Commenters are asked to suggest which approach is more likely to be resource-intensive (with respect to staff time, expertise, and money) in its implementation. As part of that discussion, commenters should identify these elements of either approach for which there is limited available technical expertise.

3. EPA is concerned that the money spent on hazardous waste management be used for these activities which best assure long-term protection of human health and the environment. EPA is interested in public comment on which regulatory approach provides the best use of money spent on environmental protection. In particular, the Agency seeks comments and data on how prospective permittees expect various approaches will affect the total and relative costs for capital equipment, operating methods and permit acquisition.

4. Taken as a whole, which approach is most likely to minimize the overall risk to society presented by hazardous waste disposal? This question ultimately subsumes all others. EPA's permit program for land disposal facilities must address all disposal facilities and must consider each facility carefully. To accomplish this with its limited resources EPA must engage in certain balancing. An approach which requires EPA to "fine tune" permit conditions to the unique characteristics of each facility will make it difficult for EPA to address all facilities. Likewise, an approach which too heavily emphasizes simplicity in permitting runs the risk of overregulating or underregulating certain individual facilities. EPA urges commenters to express their views on which approach best minimizes overall societal risk over time by allowing EPA to address as many facilities as possible in a manner that will assure adequate environmental protection at each one.

IX. Conclusion

EPA has attempted in this notice to clearly delineate the complex issues relating to permitting hazardous waste land disposal facilities and thus assist the public in analyzing and commenting on these issues. We recognize that few commenters will be able to offer responses to all of the questions set forth in this notice. Therefore, we invite all members of the public to comment on any of the issues about which they are knowledgable or able to form an opinion. In particular we urge that advocates of specific regulatory approaches comment upon the broad policy issues (especially those discussed in sections II and III of this notice) which underlie the selection of any approach.

Dated: May 7, 1981.

Walter C. Barber,

Acting Administrator.

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